Interventions at the core of scientific reasoning – on de-idealizing and re-idealizing formal logic

Bentzen, Martin Mose

Publication date:
2015

Document Version
Early version, also known as pre-print

Interventions at the core of scientific reasoning – on de-idealizing and re-idealizing formal logic

Classical logic can only deal correctly with reasoning about closed systems, whereas the world described by science is an open and dynamic system. Therefore most patterns of scientific reasoning, such as inferences about causation, abduction, model fit, etc. are ceteris paribus and in principle defeasible. However, this does not imply that logic and theory of science must be separated forever. There is a promising and refreshing trend in current logic which takes the actual reasoning of human beings seriously. This movement has been dubbed *a cognitive turn in logic*, see (Benthem, 2008), or a *naturalization of logic*, see (Woods, 2013). Common to this trend is a renewed interest in investigating the tension between the descriptive and normative aspects of logic, and an interest in strategies of coping with anomalies of traditional (classical and non-classical) logics which go beyond mere gesturing towards pragmatics. In this paper, I approach this call for a *de-idealization* of logic from a philosophy of science angle. A de-idealization of logic will require that logicians must come down from the ivory tower of their formal modelling and take a new look at actual reasoning in its natural (or perhaps social) context. However, it has been suggested at least since Kuhn that science does not deal directly with objects in themselves but with versions of objects which are at least partially shaped by the very scientific approach to them. As a consequence, naturalization is not an unproblematic term. Since we do not have direct access to our own naked reasoning, it is not just a matter of adopting empirical methods in order to establish adequacy between formal logic and natural reasoning. Rather, the process of establishing any object as an object of scientific inquiry, whether in natural science or in logic, is itself one that involves a preparation process which consists in a delimitation, abstraction and idealization of said object. As a seemingly simple example, take the preparation process leading from everyday language to logical inferences in semantical accounts of classical propositional logic. In the first step, we delimit the set of syntactically possible sentences to declarative sentences, leaving out e.g. imperatives and interrogatives. Then we abstract from most features of declarative sentences to arrive at the idea of a propositional content. Then we abstract further to the idea of a truth value. Then we idealize by concentrating only on sentences which can be regarded as instances of generic objects capable of having a truth value. In a further step of the process we delimit the theoretical context such generic objects can interact within via the classical connectives and rules of inference. At all steps of this process, choices are made which themselves require theory to be justifiable. For example, a syntactical categorization dividing sentences into declaratives, interrogatives, imperatives, etc., must be theoretically grounded in linguistics. In general, what do we do to prepare and delimit the objects of reasoning? What aspects do we isolate and how do we remove irrelevant and disturbing factors? How is reasoning shielded from disturbing contextual factors? Such questions are the focus of the first part of this paper.

A further problem with requiring a naturalization of logic is that if we do not want to give up the normative aspect of logic we can never define reasoning in completely naturalistic terms. Giving up this aspect and reducing logic to empirical psychology or cognitive science, seems either to imply giving up any concept of reasoning being *correct* which could have devastating consequences for mathematics and philosophy, or to shift the role of a normative justification of reasoning to these sciences which is equally problematic. Even if we grant that natural language or cognitive processes can provide empirical triggers for a de-idealization of logic, such a process must be seen as a possibly revolutionary intervention with core elements of our current understanding of reasoning. In order not to revert to a state of unclear informal reasoning, following de-idealization there is a need for a subsequent step of re-idealization. However, this step is,

perhaps not surprisingly, proving itself rather difficult. In philosophy of science, we do have important studies of ceteris paribus reasoning, see e.g. (van Benthem, Girard, and Roy, 2009), abduction, see e.g. (Aliseda, 2006), causation, see e.g. (Pearl, 2009) and default reasoning, see e.g. (Horty, 2012), also (Woods, 2013). However, although these studies seem to indicate that what is needed is a proper account of defeasible non-monotonic reasoning and that the boundary between pragmatics and semantics must be reinterpreted, there is as of yet no single satisfactory account of such reasoning in any of these areas, despite obvious merits of the various accounts mentioned above. Why is this? I first look at several kinds of scientific interventions of increasing depth (normal scientific/hypothetico-deductive interventions, definitional interventions, and interventions regarding interpretation of simple terms). In the second part of the paper, I argue that a de-idealization and subsequent re-idealization of logic will require an intervention of a deep kind. More specifically, I argue for a de-idealization of logic by reinterpreting its simple terms via awareness of the fact that they are objects constituted by the preparation process outlined in the first part of the paper and a subsequent re-idealization of logic which is aimed at establishing patterns of correct reasoning within the general context suggested by recent studies of non-monotonic reasoning.

References:

A. Aliseda, 2006, *Abductive Reasoning. Logical Investigations into Discovery and Explanation*, Springer.

J.F. Horty, 2012, *Reasons as defaults*, Oxford University Press.

J. Pearl, 2009, *Causality*, 2nd edition, Cambridge University Press.

J. van Benthem, 2008, 'Logic and Reasoning: Do the Facts Matter?', *Studia Logica*, 88: 67–84.

J. van Benthem, Girard, P., and Roy, O. 2009. Everything else being equal: A modal logic for ceteris paribus preferences. *Journal of Philosophical Logic* 38(1):83–125.

J. Woods, 2013, *Errors of Reasoning - Naturalizing the Logic of Inference,* College Publications.